Planetary Instrument Definition & Development Program (PIDDP)

Presented to PSD Technology Panel

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Planetary Science Division
SMD / NASA HQ

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PIDDP Objectives

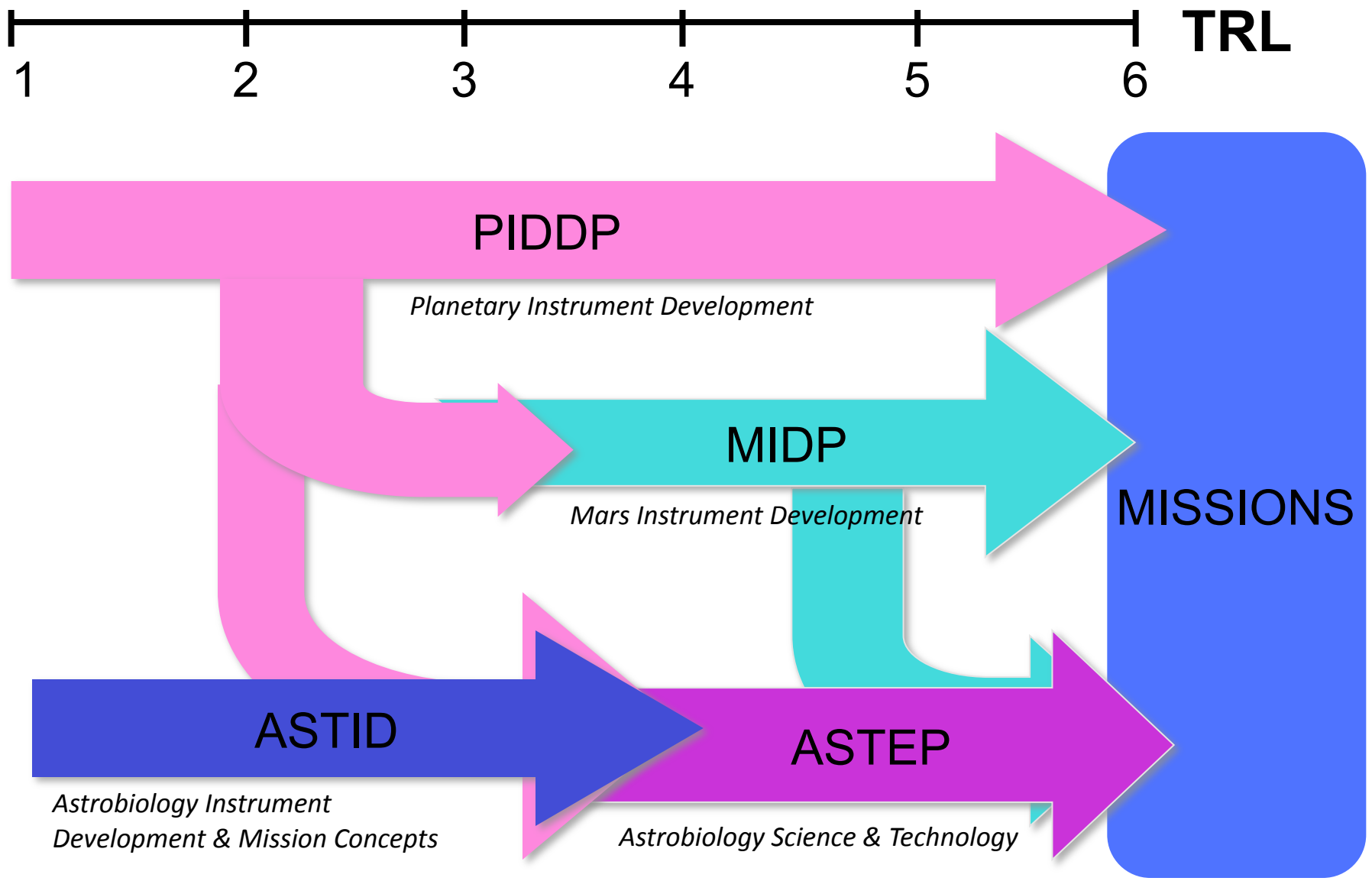
- Long-running program supports definition and development of innovative instruments for future missions in Discovery, New Frontiers, Mars Exploration Program, Lunar Initiative and Planetary Flagship missions.

- Traditionally, TRL 1-4 (up to breadboard), recently expanded to TRL 6.

- Instrument technologies include: measuring atmospheric, surface, and subsurface composition, particles and fields, and physical properties of bodies in the solar system.

- Also, support sample collection and sample handling, drills, etc. for mass spectrometers, gas chromatographs, & evolved gas analyzers.

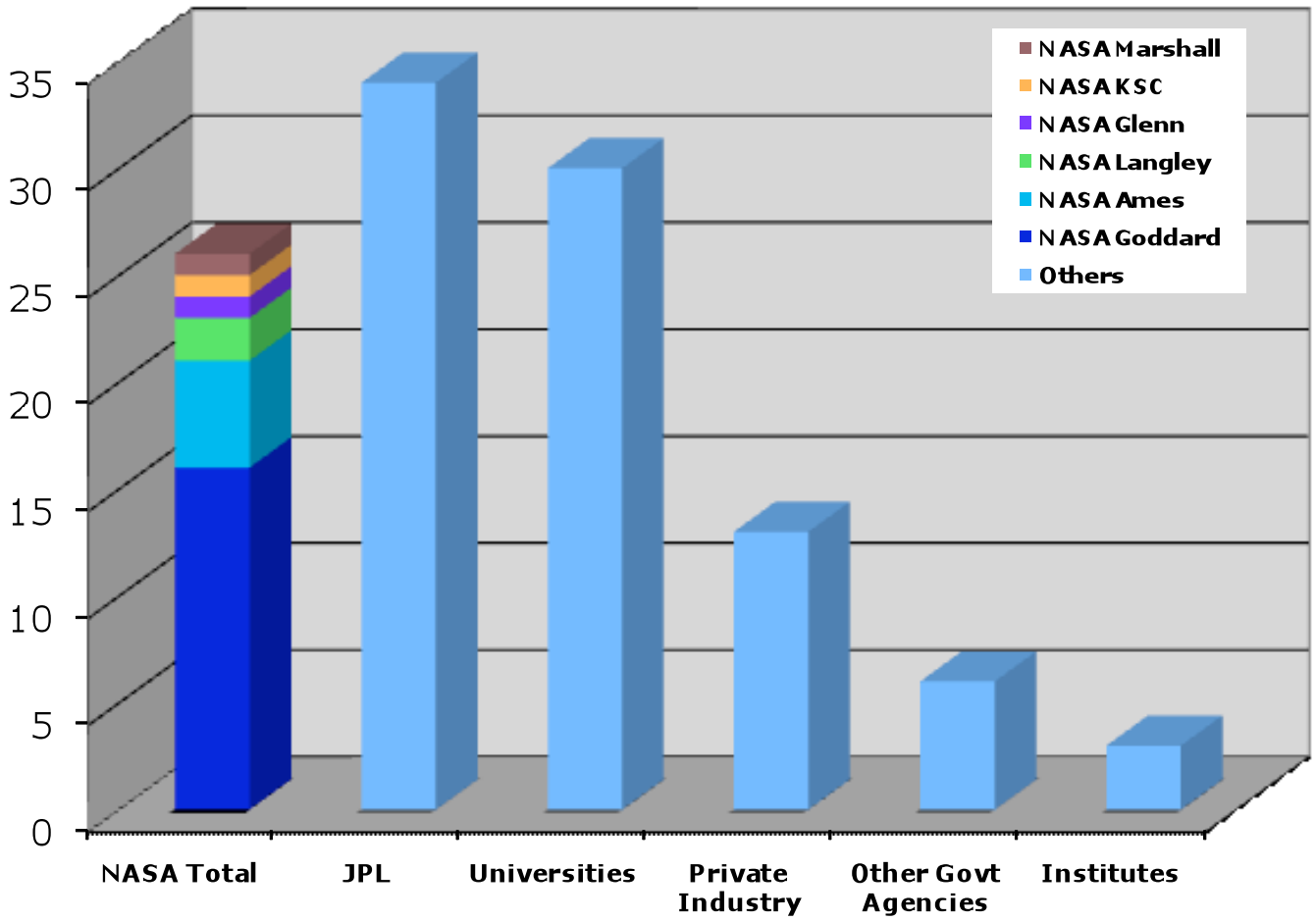
Instrument Development Programs in Planetary Science Division



PIDDP Resource Summary

Year	Number Proposals	Number Selected	Annual Budget	$Average/ Proposal	Selection Rate
FY04	50	15	7.5M	190K	30%
FY05	66	12	7.6M	230K	20%
FY06	100	10	7.7M	260K	10%
FY07	107	18	6.8M	233K	17%
FY08	115	16	10.2M	240K	14%
FY09	110	TBD	8.5M	240K	TBD

PIDDP07 Proposals - Breakdown by Institution



Decision-Making Processes Used

- An annual PIDDP call for proposals is released in the Research Opportunities in Space and Earth Science (ROSES)
- Proposals are submitted to NSPIRES by the proposal due date
- All proposals are technically reviewed by the Planetary Science community (i.e.: NASA, Industry, Academia, Other Gov)
- Proposals undergo a full Peer Panel Review evaluation where they are ranked as Must Fund, Fund If and Do Not Fund.
- The PIDDP Program Officer prepares and presents the Panel Review results to the PSD Selection Official and recommends proposals for selection. (i.e.: Source Selection Document)
- The Selection Official makes final selection decisions
- Selection Announcements
- Awards (most PIDDP awards are grants)

What Is and Is Not Working and Why

- What is working?
  - Resiliency of the planetary science community
- What is not working?
  - Increased proposal load & reduced funding > lower success rate
  - Proposal review timeliness—too much time between proposal submittals & selections
  - Program Officer has limited communication with Principal Investigators and Science Community
- Suggestions for improvement
  - Increased budget to compensate for influx of TRL 4-6 proposals
  - Reduce time between submitted and selected proposals
  - More frequent/open communication with Principal Investigators
    - Site visits, workshops, program reviews
  - More involvement with both Program Scientists and community
    - Better understanding of science needs for future PIDDP solicitations
    - Opportunities to infuse PIDDP technologies into missions

Missions Enabled by PIDDP Technologies

Missions that are currently benefitting from PIDDP technologies

- Cassini *(launched 10/97, currently providing data)*
  - Magnetospheric Imaging Instrument (MIMI)
- MESSENGER *(launched 8/3/04, currently providing data)*
  - Mercury Dual Imaging System (MDIS)
  - Magnetometer (MAG)
  - Gamma-Ray and Neutron Spectrometer (GNRS)
  - X-Ray Spectrometer (XRS)
- Lunar Reconnaissance Orbiter *(launched 6/18/09, currently providing data)*
  - Miniature Radio Frequency (Mini-RF)
- New Horizons *(launched 1/06, expected to reach Pluto by 2015)*
  - Pluto Energetic Particle Spectrometer Science Investigation (PEPSSI)
- Mars Science Laboratory *(launch delayed to 2011)*
  - Chemistry & Micro-Imaging (ChemCam)
  - Chemistry & Mineralogy (CheMin)
  - Sample & Analysis at Mars (SAM)

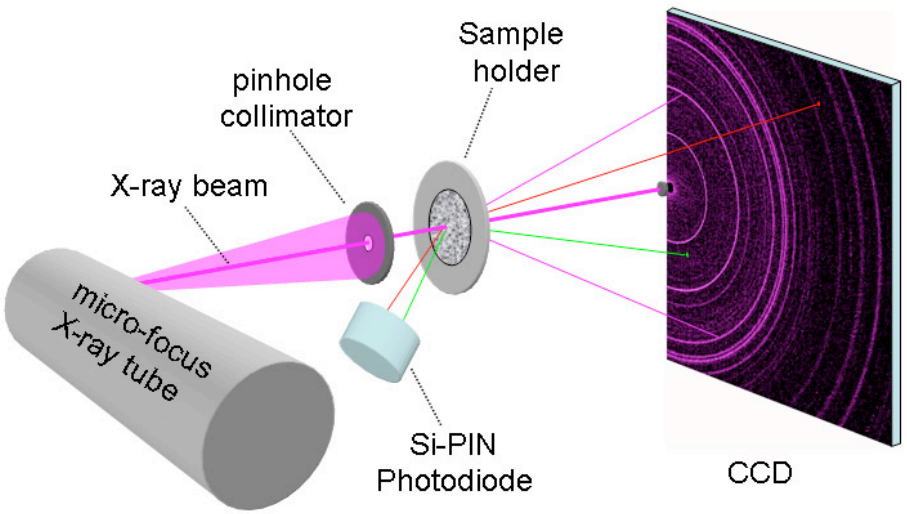
Example of PIDDP Lifecycle

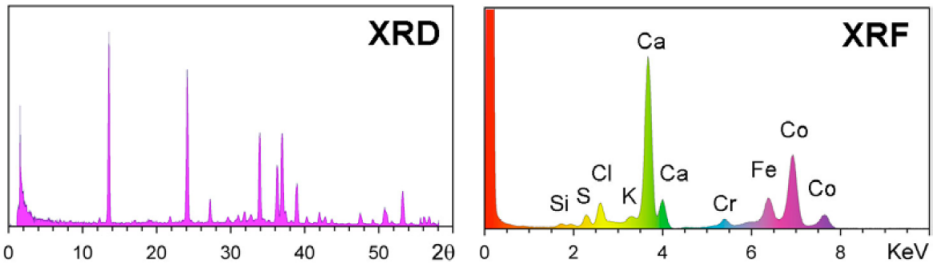
- Many Instruments on MSL have PIDDP heritage
  - ChemCam, CheMin, SAM, cameras
- CheMin XRF/XRD lifecycle:
  - PIDDP 1994 and 1997
  - ASTID 2000
  - MIDP 2002
  - MSL selection 2004

Chemistry & Mineralogy (CheMin)

Principal Investigator: David Blake

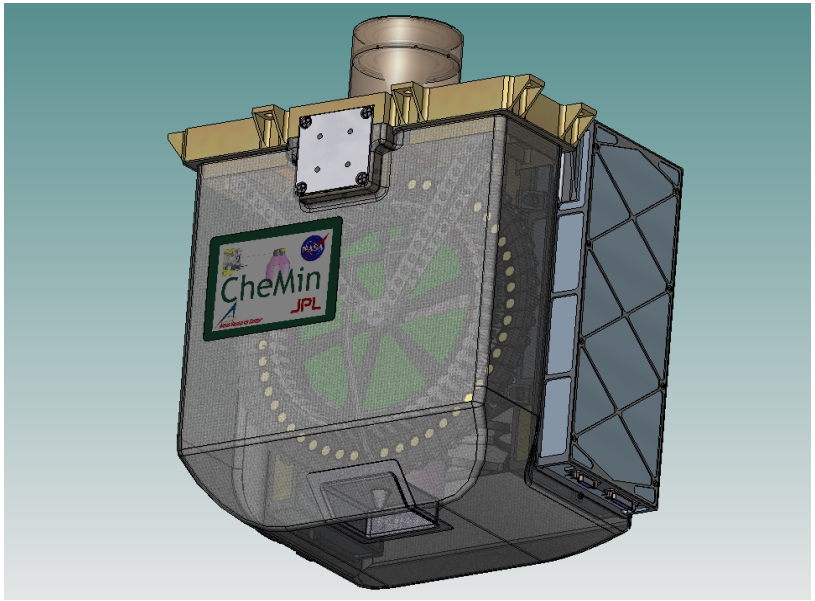
NASA Ames Research Center





CheMin performs quantitative mineralogy and elemental composition

- X-ray diffraction & X-ray fluorescence (XRD/XRF); standard techniques for laboratory analysis
- Identification and quantification of minerals in geologic materials (e.g., basalts, evaporites, soils)

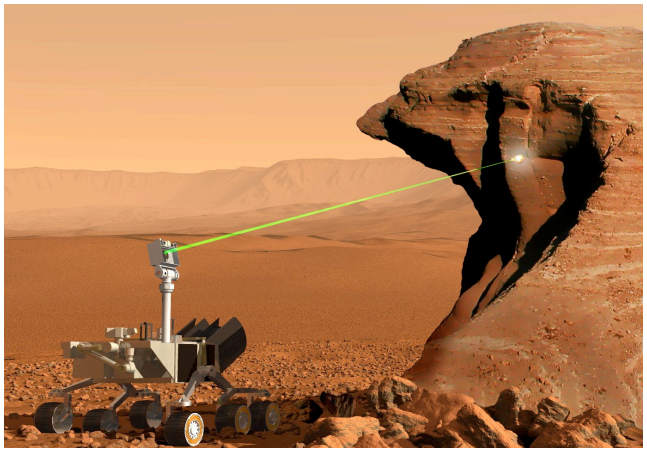


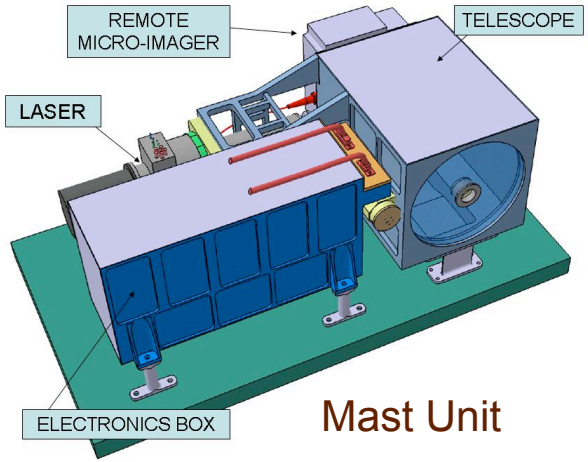
Chemistry & Micro-Imaging (ChemCam)

Principal Investigator: Roger Wiens

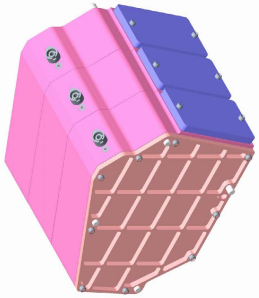
Los Alamos National Laboratory

Centre d'Etude Spatiale des Rayonnements





Mast Unit



Spectrometers

ChemCam performs elemental analyses through laser-induced breakdown spectroscopy

- Rapid characterization of rocks and soils from a distance of up to 9 meters
- 240-800 nm spectral range
- Dust removal over a ~1-cm region; depth profiling within a ~1-mm spot
- Helps classify hydrated minerals, ices, organic molecules, and weathering rinds
- High-resolution context imaging (resolves 0.8 mm at 10 m)

Sample Analysis at Mars (SAM)

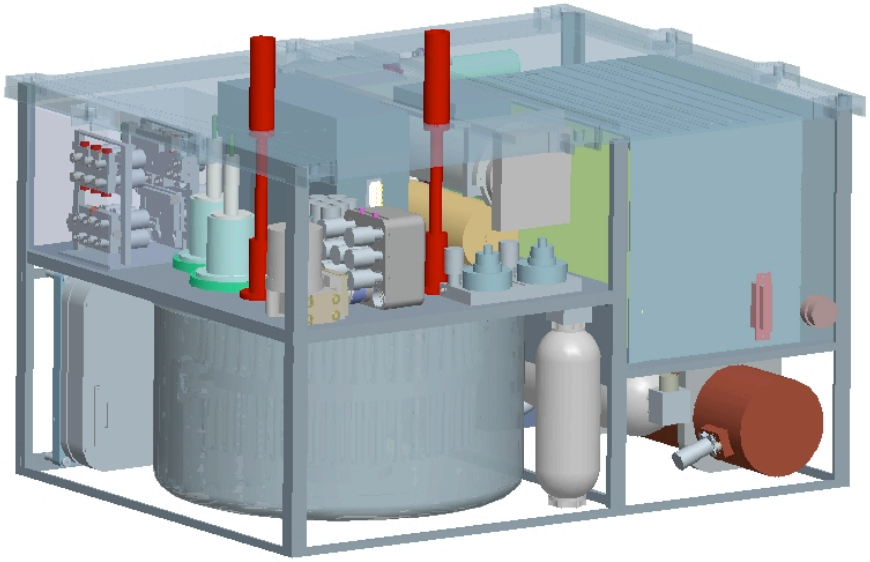
Principal Investigator: Paul Mahaffy

NASA Goddard Space Flight Center

SAM Suite Instruments

Quadrupole Mass Spectrometer (QMS)
Gas Chromatograph (GC)
Tunable Laser Spectrometer (TLS)

- Search for organic compounds of biotic and prebiotic relevance, including methane, and explore sources and destruction paths for carbon compounds
- Reveal chemical state of other light elements that are important for life as we know it on Earth
- Study the habitability of Mars by measuring oxidants such as hydrogen peroxide
- Investigate atmospheric and climate evolution through isotope measurements of noble gases and light elements



- **QMS:** molecular and isotopic composition in the 2-535 Dalton mass range for atmospheric and evolved gas samples
- **GC:** resolves complex mixtures of organics into separate components
- **TLS:** abundance and precision (3-50 per mil) isotopic composition of CH_4, H_2O, CO_2, N_2O, and H_2O_2

Future Plans

- PIDDP-09 Selection Announcement and Awards
- New PIDDP Call in ROSES-2010